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COSC 220 Project 3

System #1, Light Process:

4 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed	Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.25	87691	25003	30713	1	12	1	1
0.26	73979	26002	35818	2	28	5	4
0.27	62098	27003	42321	1	15	1	1
0.28	49011	28003	53765	1	14	1	1
0.29	36225	29003	73536	1	5	1	1
0.3	25187	30003	102841	1	18	1	1
0.31	13202	30997	225844	7	102	114	36
0.32	63	31894	5934751	110	1416	50368	960
0.33	0	31970	46828656	1034	12918	4859584	9534
0.34	0	31986	84212258	2018	25107	17127194	17203
0.35	5	32071	111554962	2933	36369	36476552	25052
0.36	0	32173	131552546	3831	47545	60104220	31506
0.37	1	31933	149248302	5071	63368	103722149	41252
0.38	0	31973	159099012	6031	74733	144162426	48093
0.39	0	32101	157921146	6903	85838	184035154	53390

You can see that between 0.32 and 0.33, the idle time has lowered to 0 or close to 0, so we look at the load values between there.

Load	Idle	Completed	Processed Wait	Unprocessed	Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.32	927	31976	1374418	28	366	2675	188
0.321	458	31976	5289190	127	1493	74863	1234
0.322	113	32004	9358504	200	2535	176052	1811
0.323	53	31961	16460398	342	4361	531325	3183
0.324	115	32032	19356410	372	4644	622498	3229
0.325	108	32017	25509424	487	6003	1114447	4524
0.326	5	31936	30921536	668	8178	2086133	6215
0.327	131	32050	29634059	653	8197	1932116	5863
0.328	2	32048	34105564	756	9452	2639185	7086
0.329	0	31946	42774042	957	11859	4281556	8985
0.33	30	31957	45561278	1047	13039	4751622	9125
0.331	0	32040	48907846	1063	13384	5299904	10097
0.332	0	32027	50729541	1177	14954	6214871	10588
0.333	0	31963	60347113	1341	16800	8068662	12049

0.334	1	31920	67158575	1484	18549	9753581	13159
0.335	0	31959	65228946	1545	18993	10845866	13771
0.336	37	31999	68418212	1605	20017	11629726	14239
0.337	0	32090	74107087	1614	20146	11189760	13775
0.338	39	32039	77678077	1765	22002	13705424	15681
0.339	1	32034	77141010	1870	23165	15658884	16703
0.34	6	31930	84511811	2074	25782	19035601	18448

The optimum load is around 0.327

8 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.5	174601	50007	52788	1	5	1	1
0.51	162366	51007	55356	1	9	1	1
0.52	149617	52007	57969	1	6	1	1
0.53	138603	53007	60826	1	9	1	1
0.54	125570	54007	64877	1	14	1	1
0.55	112666	55007	69173	1	17	1	1
0.56	100868	56007	74897	1	17	1	1
0.57	86574	57007	83467	1	12	1	1
0.58	74962	58005	93722	3	32	7	4
0.59	61091	59005	110891	3	35	14	11
0.6	49827	60007	129398	1	5	1	1
0.61	36144	61007	179043	1	17	1	1
0.62	25078	62005	233563	3	22	10	7
0.63	13288	63000	454709	8	117	77	24
0.64	0	63753	15800854	255	3097	142343	1097
0.65	58	64027	45524375	981	12207	2300163	4639
0.66	0	64004	94825654	2004	24876	8831529	8854
0.67	0	63982	128500886	3026	37606	20584728	13703
0.68	13	64068	161578282	3940	49084	34350605	17453
0.69	0	64050	195031795	4958	62008	54178900	21835
0.7	0	64153	223780196	5855	73149	73134934	25018

Optimum load is around 0.64

16 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
1	346390	100015	100743	1	9	1	1
1.01	336423	101014	102189	2	21	2	1
1.02	326869	102014	103432	2	33	2	1
1.03	310522	103014	104854	2	27	2	1
1.04	298774	104014	106363	2	26	2	1
1.05	284590	105014	107982	2	21	2	1
1.06	276317	106014	109535	2	24	2	1
1.07	262176	107014	111532	2	24	2	1
1.08	252322	108014	113442	2	21	2	1

1.09	239642	109014	115850	2	20	2	1
1.1	224131	110014	118777	2	25	2	1
1.11	212248	111014	121273	2	18	2	1
1.12	201071	112013	124024	3	43	4	2
1.13	189008	113014	127875	2	13	2	1
1.14	176354	114014	132252	2	24	2	1
1.15	162139	115014	138144	2	33	2	1
1.16	149512	116014	143281	2	14	2	1
1.17	139675	117014	150535	2	19	2	1
1.18	125027	118012	158039	4	31	7	3
1.19	113501	119014	167294	2	30	2	1
1.2	98269	120013	184115	3	26	4	2
1.21	86236	121014	198873	2	30	2	1
1.22	76491	122014	216595	2	25	2	1
1.23	59933	123014	250308	2	24	2	1
1.24	48878	124014	297173	2	28	2	1
1.25	36840	125014	367121	2	19	2	1
1.26	24509	126010	486246	6	71	16	5
1.27	13448	126990	1023286	26	324	585	52
1.28	1501	127870	7126411	146	1786	25117	351
1.29	0	127920	58590974	1096	13664	1385704	2549
1.3	14	128193	90376786	1823	22571	3689077	4088
1.31	0	128177	131712338	2839	35015	8950201	6336
1.32	27	127796	188877929	4220	52512	19932640	9445

Optimum load is around 1.28

32 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe.	Needed	Unpr. Wait	Unpr. Max Wait
2.5	76200	250028	473192	3	28	4	2
2.51	60316	251026	546480	5	57	9	3
2.52	52863	252021	596722	10	129	68	15
2.53	35594	253021	754826	10	142	56	10
2.54	22897	254025	1102740	6	59	17	5
2.55	10353	255006	2038660	25	358	227	19
2.56	755	255790	13061704	241	3016	31637	248
2.57	436	256226	31703646	805	10115	368001	911
2.58	0	256230	92709009	1801	22611	1885183	2122
2.59	0	255734	151903483	3297	41470	6194072	3734
2.6	0	256265	175700577	3766	47630	8395663	4431

Optimum load is around 2.58

64 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed	Exe. Needed	Unpr. Wait	Unpr. Wa
5.1	32237	510012	1693004	51	568	671	28
5.11	13946	511002	3176459	61	785	949	3
5.12	1810	511879	14264178	184	2230	8808	9
5.13	0	511716	62258232	1347	16734	525943	78
5.14	0	512075	99997517	1988	24708	1134254	11
5.15	0	512316	145225417	2747	33988	2233559	16
5.16	0	512361	180435227	3702	46488	3916012	21

Optimum load is around 5.13

The optimum load seems to scale with the number of cores. As the cores double, the optimum load for each core roughly doubles as well.

System #2, Medium Process:

4 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.01	365198	1003	999	1	43	1	1
0.02	330148	2003	1999	1	42	1	1
0.03	295574	3003	2999	1	33	1	1
0.04	260221	4003	4004	1	26	1	1
0.05	224753	5003	5002	1	42	1	1
0.06	190893	6003	6005	1	21	1	1
0.07	153350	7003	7015	1	38	1	1
0.08	119988	8003	8012	0	0	0	0
0.09	86200	9003	11618	0	0	0	0
0.1	50314	10003	22576	0	0	0	0
0.11	13748	11003	93264	0	0	0	0
0.12	0	11486	20292713	517	18160	5512585	21567
0.13	0	11386	26991606	1617	56343	52440309	64747
0.14	0	11391	10292827	2612	91859	121065824	91579
0.15	0	11435	21554492	3569	125130	157453027	99941
0.16	0	11416	38650172	4588	160397	190185521	99926
0.17	0	11406	41332552	5598	196217	238886781	99965
0.18	0	11439	24093302	6565	229660	302803606	99967
0.19	0	11434	7641508	7570	265362	370446725	99974
0.2	0	11431	23516058	8573	299895	405044973	99996
0.21	0	11421	42674532	9583	336499	435607350	99981
0.22	0	11419	51889585	10585	370675	477352564	99996
0.23	0	11407	56387852	11597	406289	523481250	99996
0.24	0	11470	54804555	12534	437275	571527354	99984

The idle time goes to 0 between 0.11 and 0.12, so look between those two loads to see where the optimum load is

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.111	12561	11102	102760	2	68	29	28
0.112	7829	11201	199147	3	93	28	18
0.113	5156	11299	247938	5	172	339	160
0.114	2053	11400	477477	4	147	99	53
0.115	0	11402	5190250	102	3627	245349	4870
0.116	0	11466	5695513	138	4814	356555	5535
0.117	0	11408	11969340	296	10470	1836368	12120
0.118	0	11423	14903226	381	13299	3076912	15085
0.119	0	11421	19387152	483	16908	4773697	19454
0.12	0	11427	21581377	577	19945	6772648	23167

The optimum load is around 0.115

8 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.22	31562	22007	98885	1	22	1	1
0.221	25507	22107	115635	1	47	1	1
0.222	22491	22207	147858	1	50	1	1
0.223	22209	22307	135509	1	36	1	1
0.224	15547	22407	219340	1	37	1	1
0.225	13068	22507	204315	1	48	1	1
0.226	10325	22606	236581	2	72	15	14
0.227	7154	22704	386733	4	108	33	18
0.228	3774	22802	511897	6	215	276	101
0.229	407	22801	4745041	107	3726	118556	2110
0.23	0	22826	10970849	182	6332	355952	4022
0.231	0	22818	13060279	290	10137	968872	6516
0.232	14	22822	18540186	386	13901	1588619	8604
0.233	37	22860	18847425	448	15685	2036380	9310
0.234	0	22846	23939929	562	19744	3409596	12364
0.235	0	22941	24649359	567	20070	3414477	12239
0.236	0	22875	30580908	733	25331	5721000	15725
0.237	0	22941	30446286	767	26800	6372909	16283
0.238	0	22841	38951587	967	33759	9472340	19568
0.239	0	22825	42228963	1083	37885	12468573	23281
0.24	0	22854	44088895	1154	39559	13290965	23276

The optimum load is around 0.234

16 Cores

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.45	24772	45011	280735	5	180	30	14
0.451	20096	45114	301037	2	74	4	3
0.452	16846	45211	318404	5	191	28	12
0.453	12564	45309	428434	7	232	114	42
0.454	8380	45415	611956	1	26	1	1
0.455	10038	45505	691212	11	404	925	135
0.456	5766	45603	622397	13	407	751	145
0.457	2665	45708	952297	8	305	199	73
0.458	0	45684	7365408	132	4549	84433	1326
0.459	0	45677	14110060	239	8385	337487	2719
0.46	232	45634	18688190	382	13489	764838	4007
0.461	0	45823	14460468	293	10301	450443	3057
0.462	0	45728	23935005	488	17175	1215127	5152
0.463	26	45740	24889903	576	20080	1949315	6575
0.464	0	45746	32406527	670	23168	2431269	7164
0.465	0	45724	36382859	792	27556	3515465	8734

The optimum load is around 0.460

32 Cores

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.91	16367	91021	712244	11	387	283	52
0.911	11154	91120	1025880	12	413	532	88
0.912	6173	91227	1187795	4	138	27	10
0.913	8013	91317	1106692	15	557	453	66
0.914	1093	91344	6513370	88	3262	18641	440
0.915	0	91410	8505368	122	4157	43919	721
0.916	195	91614	2625982	17	617	591	76
0.917	0	91421	20725452	311	10863	257472	1694
0.918	0	91495	14259640	337	11759	323249	1886
0.919	0	91405	25469807	527	18612	709678	2767
0.92	0	91365	32637572	666	22894	1211821	3522
0.921	0	91452	33355153	680	23644	1268079	3772
0.922	0	91593	34996087	639	22338	1150959	3541
0.923	0	91499	44356566	833	29059	1814929	4328
0.924	0	91484	45028517	947	33176	2379739	5054
0.925	0	91529	47573050	1003	35195	2770568	5493

The optimum load is around 0.916

64 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
1.82	28876	182055	835208	8	289	47	10
1.821	18824	182144	1098602	19	613	615	58
1.822	26051	182262	924183	1	40	1	1
1.823	21695	182357	1001434	6	222	60	22
1.824	22732	182418	1873704	45	1563	2556	122
1.825	8457	182517	2647399	46	1635	2401	121
1.826	11001	182615	2001404	48	1740	2706	114
1.827	3003	182737	3385651	26	937	803	68
1.828	5883	182794	3007336	69	2439	6620	189
1.829	1422	182957	3854184	6	215	23	7
1.83	0	182756	20498690	307	10405	128220	834
1.831	0	182718	26522471	445	15489	266785	1248
1.832	0	183020	16373893	243	8350	80249	669
1.833	0	182909	22242650	454	15858	281133	1211
1.834	0	182935	30294214	528	18533	358641	1405
1.835	0	182892	40871423	671	23388	566233	1756
1.836	0	183128	31313774	535	18533	397546	1460
1.837	0	182749	48289734	1014	35085	1340921	2679
1.838	0	182897	46197191	966	33515	1291275	2667
1.839	0	182891	50699048	1072	37621	1600565	2974
1.84	0	182776	64742717	1287	45436	2287484	3588

The optimum load is around 1.83

While the cores doubled, the load roughly doubled. While it isn't as precise as the light system load test, the optimum loads still doubled within the hundredths of a degree.

System #3, Heavy Process:

4 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.022	67852	2203	5137	1	163	1	1
0.023	55234	2303	8872	1	126	1	1
0.024	39554	2403	16334	1	158	1	1
0.025	26647	2503	29081	1	188	1	1
0.026	11522	2603	63097	1	103	1	1
0.027	188	2650	2666564	54	8169	213659	8371
0.028	0	2652	5900521	152	22636	2275515	29608
0.029	0	2683	6348029	221	33542	4223462	37035
0.03	0	2670	7318279	334	50112	9252987	55467
0.031	0	2665	7462796	439	64560	14330654	65130
0.032	0	2667	3437977	537	80707	23541924	85594
0.033	0	2664	1995899	640	95306	29556325	93758
0.034	0	2658	3268575	746	112496	33697510	99795
0.035	0	2658	6700616	846	127389	35149402	99915
0.036	0	2666	7320724	938	141027	39535166	99889
0.037	0	2660	9249640	1044	156144	42389945	99892
0.038	0	2659	9213238	1145	171313	48031599	99974
0.039	0	2674	9400629	1230	183014	52018341	99590
0.04	0	2669	8629170	1335	197813	57804735	99976

The optimum load is between 0.027 and 0.028, so look between there

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.027	0	2686	1188098	18	2661	31858	2963
0.0271	57	2680	1845160	34	5033	77658	4502
0.0272	115	2667	2706203	56	8764	371607	11545
0.0273	0	2675	2524407	58	8725	306254	10843
0.0274	0	2669	3262201	74	10819	578432	14891
0.0275	0	2659	3849873	94	13885	773279	17091
0.0276	13	2658	3990795	105	16323	1172192	21812
0.0277	0	2647	4885087	126	19016	1354366	23575
0.0278	0	2662	4897874	122	18404	1409733	21727
0.0279	0	2662	5243146	132	19061	1578418	23190
0.028	11	2679	4621913	125	18961	1365246	21965

The optimum load is around 0.0273

8 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.053	5982	5304	305294	4	550	342	227
0.0531	4665	5307	448735	11	1663	4055	754
0.0532	2778	5323	368739	5	703	322	113
0.0533	2740	5332	386292	6	931	2742	976
0.0534	307	5322	1056384	26	3593	22261	1723
0.0535	0	5320	2870601	38	5435	77254	3870
0.0536	156	5343	1258410	25	3828	24958	1903
0.0537	14	5331	2598240	47	7006	82406	3557
0.0538	49	5345	1664433	43	6300	61136	2863
0.0539	0	5343	3109181	55	8108	174293	6104
0.054	0	5350	2494948	58	8840	182031	6093
0.0541	258	5357	3386867	61	8980	180233	5934
0.0542	0	5331	4384043	97	14412	424718	8672
0.0543	0	5343	4459701	95	14455	364948	7735
0.0544	0	5332	5215484	116	17741	522871	8971
0.0545	0	5336	4752856	122	18641	785878	12643
0.0546	0	5337	6091314	131	19341	752972	12180
0.0547	0	5336	6648358	142	21969	834384	12194
0.0548	0	5341	6416528	147	22106	963208	13376
0.0549	0	5335	7223333	163	24819	1170646	14645

The optimum load is around 0.0542

16 Cores:

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.1	102250	10015	36050	0	0	0	0
0.101	83601	10115	44547	1	103	1	1
0.102	64155	10214	71160	2	277	11	10
0.103	55953	10315	72173	1	181	1	1
0.104	40954	10412	108227	4	578	80	49
0.105	28240	10515	132470	1	117	1	1
0.106	7937	10611	298297	5	735	211	114
0.107	0	10667	3710323	49	7304	57624	2234
0.108	0	10677	6540738	139	20755	433338	6167
0.109	0	10683	9870125	233	33879	1192867	10496
0.11	0	10693	14465310	323	48314	2290249	14173

The optimum load is around 0.107

32 Cores

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.2	195158	20031	41831	1	158	1	1
0.201	177128	20131	46275	1	182	1	1
0.202	165523	20231	48241	1	134	1	1
0.203	148985	20331	56167	1	196	1	1
0.204	146211	20431	62067	1	111	1	1
0.205	123676	20531	78128	1	119	1	1
0.206	104049	20631	88375	1	152	1	1
0.207	96374	20729	97218	3	471	21	15
0.208	76579	20831	119057	1	174	1	1
0.209	63879	20927	148327	5	711	51	20
0.21	44772	21028	191135	4	572	69	48
0.211	32370	21131	258240	1	159	1	1
0.212	24432	21230	315960	2	347	6	5
0.213	0	21322	1664072	10	1493	424	118
0.214	0	21353	3963644	79	11839	77739	1926
0.215	0	21311	11989080	221	32907	485364	4419

The optimum load is 0.213

64 Cores

Load	Idle	Completed	Processed Wait	Unprocessed Exe. Needed	Unpr. Wait	Unpr. Max Wait
0.42	103359	42063	227974	0	0	0	0
0.421	92829	42163	280745	1	167	1	1
0.422	69377	42261	311233	2	291	32	29
0.423	49798	42363	475681	1	146	1	1
0.424	38404	42438	619870	25	3861	3692	321
0.425	23397	42560	674258	4	568	19	10
0.426	1208	42649	4026978	14	1988	518	78
0.427	0	42668	7467680	96	14241	47394	1026
0.428	0	42667	15036649	196	28904	204614	2117
0.429	0	42725	13662997	239	35722	348374	2973
0.43	0	42680	18881501	383	57456	856392	4466

The optimum load is around 0.427

Just like all the other simulations, in the heavy process system the optimum load seems to double as the cores double. However, just like the medium process system, it is still a little bit imprecise. The precision seems to weaken as the processes get heavier.